Title: **FINNED VIBRATION DAMPER FOR ARCHERY BOW**

Inventor: **Robert Lee Donovan**

CROSS REFERENCE TO RELATED APPLICATIONS

This is a DIVISIONAL APPLICATION and claims the benefit of pending, prior filed, nonprovisional Application Number 10/087,148, filed on February 28, 2002, entitled FINNED VIBRATION DAMPER FOR ARCHERY BOW.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to rubbery dampers designed to reduce vibration and absorb shock in an archery bow. The disclosed invention is a finned damper which is resilient and flexible and may be mounted to any part of an object, such as an archery bow, so that the damper will not interfere with the object's use, yet the damper reduces undesired vibrations generated by and during the object's use. The disclosed invention has been tested and proven to provide more damping than rubber dampers currently available.

2. Discussion of the Prior Art

Archery bows tend to generate undesirable vibrations and noise during use. These can detract from the performance of the

bow and the archer. In archery, the archer nocks an arrow and draws his or her bow, hoping to shoot the arrow straight and sure to hit a target some distance away. The drawing of the bow stores potential energy in the bow and bowstring, which when released impart kinetic energy by a forward thrust to the arrow. When the bowstring is released, most of the stored energy is transferred to the arrow, causing the arrow to fly according to the force and direction of the bowstring travel. However, a portion of the energy is not transferred to the arrow, but is instead reflected back into the bow and transferred back to the archer's bowhand. Ideally, all of the stored energy should be transferred to the arrow. But this is not possible due to the physics, mechanics, and dynamics of the bow, bowstring, and arrow system configuration. This returned energy appears to the archer as a recoil, or kick, felt in his or her bow arm. When the bowstring is released, the limbs accelerate forward and engage in a series of rapid vibrations which ultimately die down. This series of vibrations may be so forceful as to affect the flight of the arrow. One way to lessen the effect of these vibrations is through the use of stabilizer rods. Stabilizers are weighted devices which are mounted to the riser area of the bow and are designed to reduce torque and absorb vibration generated upon release. The stabilizers are mounted to the back of the bow (the side which faces the target and faces away from the archer) and help lessen the vibration of the bow limbs. Mechanical dampers are also used to reduce bow vibrations. These mechanical dampers are usually mounted to the front of a bow below the grip. In a conventional mechanical damper, a metal cylinder is filled with

oil and a piston in the cylinder is allowed to travel back an forth within the oil-filled cylinder, thereby damping vibrations.

Several patents disclose vibration damping devices for use with sports equipment, hand tools, and other such devices. U.S. Patent No. 5,362,046 to Sims (1994) shows a vibration damping device for implements which are subject to impact. The Sims patent is disclosed and claimed for use with an "implement", defined as "wielded devices designed to impart and receive impacts", such as golf clubs, baseball bats, tennis rackets, and hammers. See Sims at Col. 1:12-16. However, although the patent is restricted to the wielded devices, the disclosed damper is commercially available and marketed as an archery bow damper, called the "LIMB SAVER". This device has a mushroom-like configuration provided by a head and an integral stem and is fabricated from a soft elastomeric material. The stem is capable of oscillating over a 360° span in directions generally normal to the longitudinal axis of the device. The peripheral part of the head can oscillate around its circumference in directions generally paralleling that axis. For this vibration damping device to function effectively, it is essential that the ratio between the diameter d of the head and length l of the stem be between 5:1 and 1:1. U.S. design Patents Nos. D436,643 and D445,161, also issued to Sims (2001), show an archery bow shock absorber and a vibration damper, respectively, in the knob and stem configuration.

SUMMARY OF THE INVENTION

It is one of the objects of the present invention to provide a finned vibration damper, made of a resilient elastomeric material, that provides superior damping. It is another object of the present invention to provide a finned vibration damper that will enhance the performance of an archery bow. Another object of the present invention is to provide a finned vibration damper that will reduce vibration of the limb and noise of the bow during use. It is another object of the present invention to provide a finned vibration damper that will reduce the bow's recoil. It is another object of the present invention to provide a finned vibration damper which may be attached to any part or surface of an archery bow. It is another object of the present invention to provide a vibration damper which can conform to the shape of and firmly engages an archery bow limb. Another object of the present invention is to provide a finned vibration damper that will not interfere with the use of the archery bow. Another object of the present invention is to provide a finned vibration damper that is of simple design and economical manufacture and has a long in-service useful life. It is another object of the present invention to provide a finned vibration damper that is easy to install and remove, small and lightweight, inexpensive, and easy to store when not in use.

The invention discloses a finned vibration damper which is made of a resilient and pliable elastomeric material such that the material properties lend themselves to energy absorption.

The invention further discloses a vibration damper in which the resilient material is formed into a series of fins which absorb vibration imparted to an archery bow. In one alternative embodiment of the present invention, the damper is formed with a series of fins and a base that extends beyond the fins at each end. The base extensions aid in attachment of the damper by allowing it to be wrapped around any cross-section of the vibrating object, such as an archery bow. In this embodiment the base extensions may be further modified by forming into them a series of interlocking teeth and grooves, which help strengthen the attachment of the damper around a vibrating object, such as a bow's mechanical damper or counterweights. In yet another alternative embodiment of the present invention, the damper is formed in a ring with fins, so that the damper can be stretched over a cylindrical object, such as an archery counterweight or mechanical damper.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric view of one preferred embodiment of the finned damper, seen from the top.

Figure 2 is another isometric view of the preferred embodiment of the finned damper, seen from the bottom.

Figure 3 is an orthogonal view of the preferred embodiment of the finned damper, seen from the side.

Figure 4 is an isometric view of another preferred embodiment, a wrap-around finned damper, seen from the top.

Figure 5 is another isometric view of the preferred embodiment of the wrap-around finned damper, seen from the bottom.

Figure 6 is an orthogonal view of the preferred embodiment of the wrap-around finned damper, seen from the side.

Figure 7 is an orthogonal view of the preferred embodiment of the wrap-around finned damper, seen from the side and mounted to a cylindrical surface.

Figure 8a is an orthogonal view of yet another embodiment of the invention, a finned ring damper, seen from the side and mounted to a cylindrical surface, such as a mechanical damper or counterweight.

Figure 8b is an orthogonal view of yet another embodiment of the finned ring damper, seen from the side.

Figure 8c is a cross-section side view of the finned ring damper.

Figure 9 is a general view of an archery bow with the preferred embodiments shown attached in several possible places.

Figure 10 is a graph showing the frequency and amplitude of vibrations in an undamped archery bow.

Figure 11 is graph showing the frequency and amplitude of vibrations in an archery bow damped by an un-finned damper.

Figure 12 is graph showing the frequency and amplitude of vibrations in an archery bow damped by the finned damper of the present invention.

DESCRIPTION OF THE INVENTION

Figures 1, 2, and 3 show one embodiment of the present invention. A finned damper **10** is made of a resilient, elastomeric material, such as rubber, elastomer, and elastic polymers. The damper **10** is molded into a base **11** with a series of fins **12** extending up from it. The embodiment shown in Figures 1 through 3 has a rectangular base **11** with a flat bottom **13**. For archery bow dampers, the finned damper can be roughly one inch wide, three inches long, and an inch high. These dimensions allow the damper to fit on various parts of the most common bows. For example, as shown in Figure 9, the finned damper **10** may be mounted to the limb **41** of an archery bow **40**, either on the inner **47** or outer **48** surface, and either close to the grip **42**, as indicated by **10'**, or close to the pulleys **48**, as indicated by **10''**. Fins **12** extend up from the base **11**. The finned damper **10** may be fixed to an archery bow with conventional adhesives, such as glue or tape with adhesive on both sides. For example, Figure

3 shows the finned damper **10** with a layer of adhesive **14** on the bottom surface **13**. The adhesive is covered by a peel-off strip **15**. To fix the finned damper **10** to a bow limb, the strip **15** is peeled off, revealing the adhesive layer **14**, then the damper **10** is pressed to the bow limb until the adhesive **14** sticks. The finned damper **10** can be mounted to almost any surface of an archery bow. As additional examples, the finned damper **10** can be fixed on a conventional bow mounted quiver.

Figures 4, 5, and 6 show another embodiment of the present invention. The finned wrap-around damper **40** is made of a resilient, elastomeric material, such as rubber, elastomer, and elastic polymers. A finned wrap-around damper **40** is molded to form a series of fins **22** on a base structure **21**. Base structure **21** is further comprised of a distal lengthwise extension portion **23**, a middle portion **28**, and a proximal lengthwise extension portion **29**. Distal lengthwise extension **23** is further divided into a top portion **24** and bottom portion **27**. Top portion **24** is formed into a series of alternating raised ribs **25** and recessed grooves **26**. Bottom portion **27** is a flat surface in this embodiment. Proximal lengthwise extension **29** is further divided into a top portion **30** and bottom portion **31**. Top portion **30** is a flat surface in this embodiment. Bottom portion **31** is formed into a series of alternating raised ribs **32** and recessed grooves **33**. At the middle portion **28** of the wrap-around damper **20**, the bottom **36** is formed as a flat surface **34**, and the top portion **35** is formed into the series of fins **22**.

Figure 5 is a bottom isometric view which shows the bottom **36** of base structure **21** in greater detail. Bottom portions **34** and **27** are flat surfaces, and bottom portion **31** is formed into a series of alternating raised ribs **32** and recessed grooves **33**. Figure 6 is a front orthogonal view also showing the wrap-around finned damper **20** in detail, with its fins **22**, and extension portions **23** and **29** with their raised ribs **25** and recessed grooves **26** at the distal end **23**, and complimentary ribs **32** and grooves **33** at the proximal end **29**. The ribs **25** and grooves **26** at the distal end **23** are designed to engage the complimentary ribs **32** and grooves **33** at the proximal end. For example, Figure 9 shows various places on an archery bow **40** where the wrap-around finned damper **20** may be fixed. Many bows **40** have mechanical dampers **43**, usually cylindrical in shape, mounted to the front **46** of the bow **40** near the grip **42**. Thus, as shown in greater detail in Figure 7, the wrap-around finned damper **20** can be wrapped around a cylindrical surface, such as a mechanical damper **43**, and the distal **23** and proximal **29** ends can engage the complimentary ribs, **25** and **32**, and grooves, **26** and **33**. As an additional example, this same type of system can also be used to fix the wrap-around damper **20** to conventional archery bow counterweights (not shown), which are also usually cylindrically shaped. As with the finned damper **10** described above, the wrap-around finned damper **20** may also be fixed to a flat surface of a bow **40**. Thus, flat bottom portions, **34** and **27**, can be used as surfaces to fix the damper **20** by means of glue or tape with adhesive on both sides. For example, Figure 6 shows an adhesive layer **37**, covered by a peel-off strip **38**, applied to the flat bottom portions, **34** and **27**.

Thus, the peel-off strip **38** can be removed and the damper **20** can be fixed to any part of the bow **40**, such as to a limb **41**, or to a mechanical damper **43** or a counterweight (not shown). Glue or any other conventional adhesive may also be applied to the top **24** of the distal end **23**, or the bottom **31** of the proximal end **29**, or to both, so that the ribs **25** and grooves **26** at the distal end **23** engage the complimentary ribs **32** and grooves **33** at the proximal end and the glue holds the ends, **23** and **29**, together.

Figure 8a shows yet another embodiment of the present invention. The finned ring damper **50** is made of a resilient, elastomeric material, such as rubber, elastomer, and elastic polymers. A finned ring damper **50** is molded to form a series of fins **52** on a base structure **51**. Base structure **51** forms a ring with an inner surface **53**. The ring damper **50** may be mounted to any object over which it can be stretched, such as a mechanical damper **43**, as seen in Figure 9, or a counterweight (not shown). The ring damper **50** can be held in place by the friction of stretching the rubbery material over an object or by fixing it to an object with adhesive or glue, as described above.

Figures 8b and 8c show yet another embodiment of the finned ring damper. The finned ring damper **50'** is made of a resilient, elastomeric material, such as rubber, elastomer, and elastic polymers. A finned ring damper **50** is molded to form a series of fins **52** on a base structure **51**. Base structure **51** forms a ring with an inner surface **53**. An mounting insert **55** fits into the inner surface **53** of the ring damper **50'**. The mounting insert **55**

is cup-shaped and has a mounting hole **56**. The mounting hole **56** can receive a bolt (not shown) to secure the damper **50'** to an object, such as an archery bow. For example, as shown in Figure 9, the limb bolts (not shown) that secure the bow limbs **41** to the grip structure **42**, can be used to mount the finned damper **50'** to the bow. In an additional embodiment, the cavity formed by the cup of the mounting insert **55** can be filled with a foam insert **57**, for increased damping.

The present invention provides excellent damping. Figures 10, 11 and 12 are graphs showing the results of experiments using an archery bow vibration testing rig at the University of Idaho College of Engineering. The testing rig holds a conventional compound archery bow and was set up to measure the duration and amplitude of vibrations generated by bowstring pulled back to its fully stretched position and released. The duration of vibrations is plotted on the horizontal axis and increments of 0.2 seconds are shown. The amplitude of vibrations is plotted on the vertical axis, measured electronically by potential and shown in increments of 0.5 volts. Figure 10 shows is a graph of a bow without any damper. It can seen that the duration of vibrations lasts about 04. Seconds and the amplitude spikes several times, with a measured maximum of almost 2.5 volts. Figure 11 is a graph of a currently available damper marketed and sold as an archery bow damper, substantially similar in design to the damper shown in U.S. Patent No. 5,362,046, discussed above. The prior art damper was mounted to the test bow on the inner surface (**47** in Figure 9) of the bow limb (**41** in Figure 9), near the pulleys

(**48** in Figure 9). Figure 11 shows that the prior art damper reduces the duration of vibrations to under 0.3 second and reduces the maximum measured amplitude to just under 2.0 volts. Figure 12 is a graph of the preferred embodiment of the present invention, as shown in Figures 1 through 3. The finned damper **10** of the present invention was mounted to the test bow in the same place as the prior art damper: on the inner surface (**47** in Figure 9) of the bow limb (**41** in Figure 9), near the pulleys (**48** in Figure 9). Figure 12 shows that the finned damper of the present invention provides significantly greater damping than the prior art damper. The finned damper of the present invention reduces the duration of vibrations to about 0.15 second and reduces the maximum measured amplitude to just under 1.5 volts.

The drawings and description set forth here represent only some embodiments of the invention. After considering these, skilled persons will understand that there are many ways to make a finned vibration damper according to the principles disclosed. The inventor contemplates that the use of alternative structures, which result in a finned vibration damper using the principles disclosed and the invention claimed, will be within the scope of the claims.